



San Francisco Bay Area Network Vital Signs Monitoring Program

Overview

As part of the National Park Service's effort to "improve park management through greater reliance on scientific knowledge," a primary role of the Inventory and Monitoring (I & M) Program is to collect, organize, and make available natural resource data and to contribute to the Service's institutional knowledge by transforming data into information through analysis, synthesis, modeling, and reporting. Knowing the condition of natural resources in national parks is fundamental to the National Park Service's ability to manage park resources "unimpaired for the enjoyment of future generations." The challenge of protecting and managing a park's natural resources requires a broad-based knowledge of the status and trends of resources. Most parks are open systems vulnerable to threats such as air and water pollution and invasive species, which often originate outside of the park's boundaries. Understanding the dynamic nature of park ecosystems and the consequences of human activities is essential to maintain, enhance, or restore the ecological integrity of park ecosystems and to avoid, minimize, or mitigate threats to these systems.

History of the National Park Service I&M Program

The National Park Service I&M Program was initiated in 1992 with a focus on completion of basic resource inventories for all parks with significant natural resources, and development of prototype monitoring programs. The program received special funding from Congress in 2000 through the "Natural Resource Challenge" in order to encompass a larger number of parks. Under the I&M program approximately 270 park units have been organized into 32 networks to conduct long-term resource monitoring. Parks within a network share funding and professional staff to improve efficiency and reduce costs.

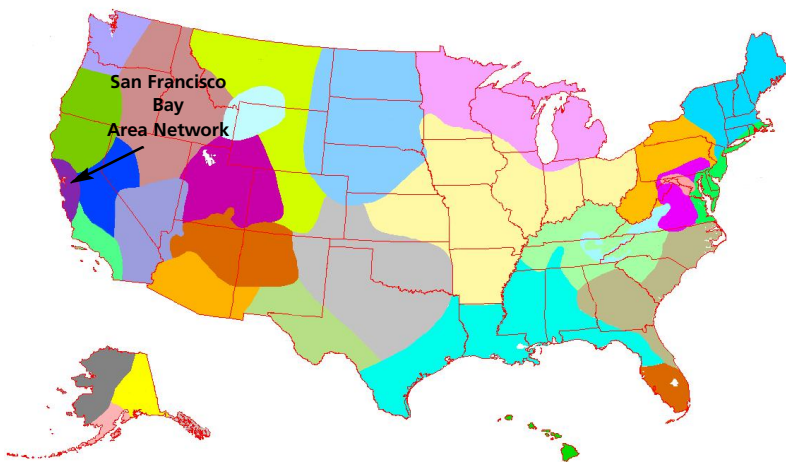


The mission of the San Francisco Bay Area Network Monitoring Program is to monitor the status and trends of the region's ecosystem health and provide information that enables the parks to better manage and interpret their natural resources.

They also partner with universities, federal and state agencies, and many nongovernmental agencies to complete basic park resource inventories and monitor the condition of selected resources. The San Francisco Bay Area Network (SFAN) is one of these 32 local networks (see map to left) organized into the National I&M Program and includes seven National Park Service sites.

The San Francisco Bay Area Ecosystem

The SFAN parks are within the Central California Coast Ranges and share many ecological systems and associated anthropogenic influences which include invasions of non-native species, altered fire regimes, degraded air and water quality, heavy recreational pressure, adjacent habitat loss, and



Each colored section on this map represents a different organizational network encompassing several national park system sites. Seven parks fall within the San Francisco Bay Area Network (see page 2 for specific names of parks).

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Vital Signs Monitored by the San Francisco Bay Area Network

(See "Chart Key" page 3)

Category	Vital Sign	Measure	Management Application	EUON	FOPO	GOGA	JOMU	MUWO	PINN	PORE
Air and Climate	Weather and Climate	Ambient temperature, precipitation.	Supports understanding of local climate change.	◆	◆	◆	◆	◆	◆	◆
	Air Quality	Atmospheric ozone concentration. Wet and dry deposition chemistry (pH, NO ₃ ⁻ , SO ₄ ⁻). Visibility (PM 2.5 mass fraction).	Minimize air pollution exposure to park visitors and staff.	⊖	⊖	○	⊖	⊖	○	○
Water	Freshwater Quality-Water Chemistry	Core parameters (pH, dissolved oxygen, specific conductance, temperature). Fecal and total coliform in some areas.	Identify excesses or deficiencies to particular core water parameters. Identify pollution sources. Ensure that NPS meets minimum water quality standards.	-	-	◆	◆	◆	◆	◆
	Freshwater Dynamics	Flow discharge (CFS), gauge/stage height.	Identify threats to maintaining stream flow for threatened and endangered species.	-	-	◆	◆	⊖	◆	◆
Ecosystem Patterns and Processes	Landscape Dynamics	Dominant cover types in the region and patch size. Landuse intensity.	Evaluate ecosystem conversion, inform regional assessments of landuse change. Derive importance of park land in rapidly urbanizing landscape.	◆	◆	◆	◆	◆	◆	◆
Biological Integrity	Wetlands	Extent, type, condition, and function.	Identify need for wetland restoration.	-	-	◆	◆	◆	◆	◆
	Riparian Habitat	Species composition in riparian habitat. Extent of habitat.	Identify need for riparian habitat restoration.	-	-	◆	◆	⊖	◆	◆
	Plant Community Change	Species diversity and amount of cover of priority vegetation communities.	Develop priorities for habitat management (e.g. invasive species, control of disease) and restoration.	-	◆	◆	◆	◆	◆	◆
	Invasive Plant Species	Detect new species and treat populations.	Identify where immediate eradication efforts are needed.	◆	◆	◆	◆	◆	◆	◆
	Rare Plant Species	Presence, absence, status, threats.	Identify need for species and/or habitat restoration.	-	-	◆	○	-	◆	◆
	Threatened and Endangered Butterflies	Distribution and available habitat.	Meet legal obligation to monitor endangered species. Identify population threats and evaluate need for species and/or habitat restoration.	-	-	◆	-	-	-	◆
	Stream Fish Assemblages	Abundance and sex ratio of coho salmon and steelhead trout. Fish species diversity. Abundance of California freshwater shrimp.	Meet legal obligation to monitor threatened and endangered species. Identify species and/or habitat restoration.	-	-	◆	◆	◆	◆	◆
	Amphibians and Reptiles	Species diversity and abundance.	Identify need for species and/or habitat restoration.	⊖	⊖	◆	◆	◆	◆	◆
	Landbird Population Dynamics	Species composition and abundance in chaparral and riparian habitat.	Recommend and evaluate land management efforts.	⊖	⊖	◆	◆	⊖	◆	◆
	Western Snowy Plover	Abundance in breeding (PORE) and wintering population (GOGA).	Meet legal obligation to monitor endangered species. Identify need for species and/or habitat restoration.	-	-	◆	-	-	-	◆
	Northern Spotted Owl	Abundance, reproductive success, and distribution.	Meet legal obligation to monitor threatened and endangered species. Identify need for species and/or habitat restoration.	-	-	◆	-	◆	-	◆
	Raptors and Condors	Distribution, abundance, and reproductive success of breeding population.	Manage visitor use (e.g. climbing) to minimize disturbance to nesting raptors.	-	⊖	○	⊖	⊖	◆	⊖
	Pinnipeds	Abundance, distribution, and reproductive success of annual breeding population.	Identify threats and need for habitat protection.	-	-	◆	-	-	-	◆



Monitoring plant species is a high priority for SFAN.

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climate change with associated sea level rise. The parks are extremely diverse in natural resources and have a unique set of complex management challenges within a densely populated setting. Most of the SFAN units are included in the Central California International Biosphere Reserve, and are part of the California Floristic Province, an area noted by Conservation International as a hotspot of biodiversity.

Vital Signs Monitoring

The monitoring aspect of the I&M Program has become known as "Park Vital Signs Monitoring." Park vital signs monitoring is designed to inform managers of the condition of water, air, geologic resources, plants and animals, and the various ecological, biological, and physical processes that act on those resources. This type of

information is essential to assess the effectiveness of management and restoration activities, and to provide early warning of emerging threats.

Vital signs are (1) select physical, chemical, or biological elements or processes of park ecosystems; (2) known or hypothesized effects of stressors; or (3) elements that have important human values. Vital signs selected for monitoring are a subset of the total suite of natural resources that park managers are directed to preserve. In situations where natural areas have been so highly altered that physical or biological processes no longer operate (e.g., natural fire and flooding regimes), information obtained through monitoring can help managers understand how to implement the most effective approach to managing, protecting, or restoring natural systems. Long-term vegetation data, for example, can support habitat restoration and trigger the removal of invasive plants. Knowledge about the status of rare, threatened and endangered species will be critical for preservation, park planning efforts, and providing visitors with the experience they expect while visiting a site within the National Park Service.

There are 18 high priority vital signs (see table page 2-3). Vital signs selected for monitoring in the SFAN are divided into four broad categories including "air and climate," "water," "biological integrity," and "ecosystem patterns." Measures are determined

for each vital sign along with applicable management application.

Integration with Management

As part of the Service's efforts to improve park management through greater reliance on scientific knowledge, a primary purpose of the monitoring program is to develop, organize, and make available natural

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Seven Parks of the San Francisco Bay Area Network

- o Eugene O'Neill National Historical Site
- o Fort Point National Historic Site
- o Golden Gate National Recreation Area
- o John Muir National Historic Site
- o Muir Woods National Monument
- o Pinnacles National Monument
- o Point Reyes National Seashore



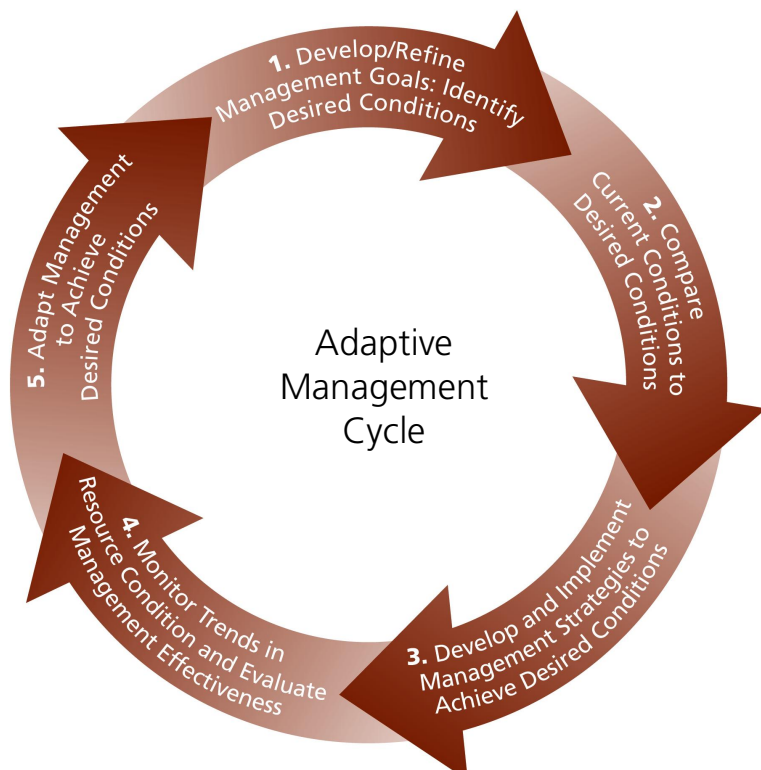
Green areas represent physical locations of parks in the San Francisco Bay Area Network. Major bodies of water are marked for reference points.

Chart Key

Parks of the San Francisco Bay Area Network:

EUON	Eugene O'Neill National Historic Site
FOPO	Fort Point National Historic Site
GOGA	Golden Gate National Recreation Area
JOMU	John Muir National Historic Site
MUWO	Muir Woods National Monument
PINN	Pinnacles National Monument
PORE	Point Reyes National Seashore

- ◆ Vital signs for which the network will develop protocols and implement monitoring using funding from the vital signs or water quality monitoring programs.
- Vital signs that are monitored by a network park, another NPS program, or by another federal or state agency using other funding. The network will collaborate with these monitoring efforts.
- ⊖ High priority vital signs for which monitoring will likely be done in the future, but which cannot currently be implemented because of limited staff and funding.
- Vital sign does not apply to park, or for which there are no foreseeable plans to conduct monitoring.



(continued from page 3)

resource data by transforming data into useful information through analysis, synthesis, modeling, and reporting. Vital signs monitoring will be an integral part of the adaptive management cycle by providing critical information about trends in natural resource conditions. The information will be available to identify desired conditions and evaluate management effectiveness. To help deliver the information needed at the park, network, regional, and national levels, the vital signs networks are designing a system for scientific data collection, analysis, and reporting that is unprecedented in the National Park Service.

The Vital Signs Monitoring Program is an integral part of the adaptive management cycle by providing critical information.

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<http://www1.nature.nps.gov/im/units/sfan/index.htm>

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Examples of San Francisco Bay Area Network Monitoring



Raptors

Annual raptor monitoring at Pinnacles National Monument provides critical data to help manage climbing areas in a way to reduce disturbance to nesting birds. The scientifically gathered information benefits birds by reducing disturbance during the critical nesting period and benefits park visitors by identifying those areas without raptor nesting that can still be used for climbing activities.



Pinnipeds

Golden Gate National Recreation Area and Point Reyes National Seashore provide important habitat to pinnipeds. Harbor seals are monitored at Golden Gate National Recreation Area and northern elephant seals, harbor seals, Steller sea lions, and California sea lions are monitored at Point Reyes. Pinnipeds are protected by federal law under the Marine Mammal Protection Act. Steller sea lions are also protected by the Endangered Species Act. Long-term monitoring provides information about the population trends and health, and human disturbance, which guides management for safeguarding the species and their habitats.



Western Snowy Plovers

Snowy plovers nest at Point Reyes National Seashore. Long-term monitoring indicated a decline of nesting success over the past 30 years. This decline triggered management efforts to protect nesting birds from predators and park visitors, and to restore nesting habitat. Continued monitoring during the nesting season has already shown that a volunteer docent program initiated in 2001 has been extremely successful at increasing nesting success by reducing disturbance.